

# The History of Medicine Through Tuberculosis

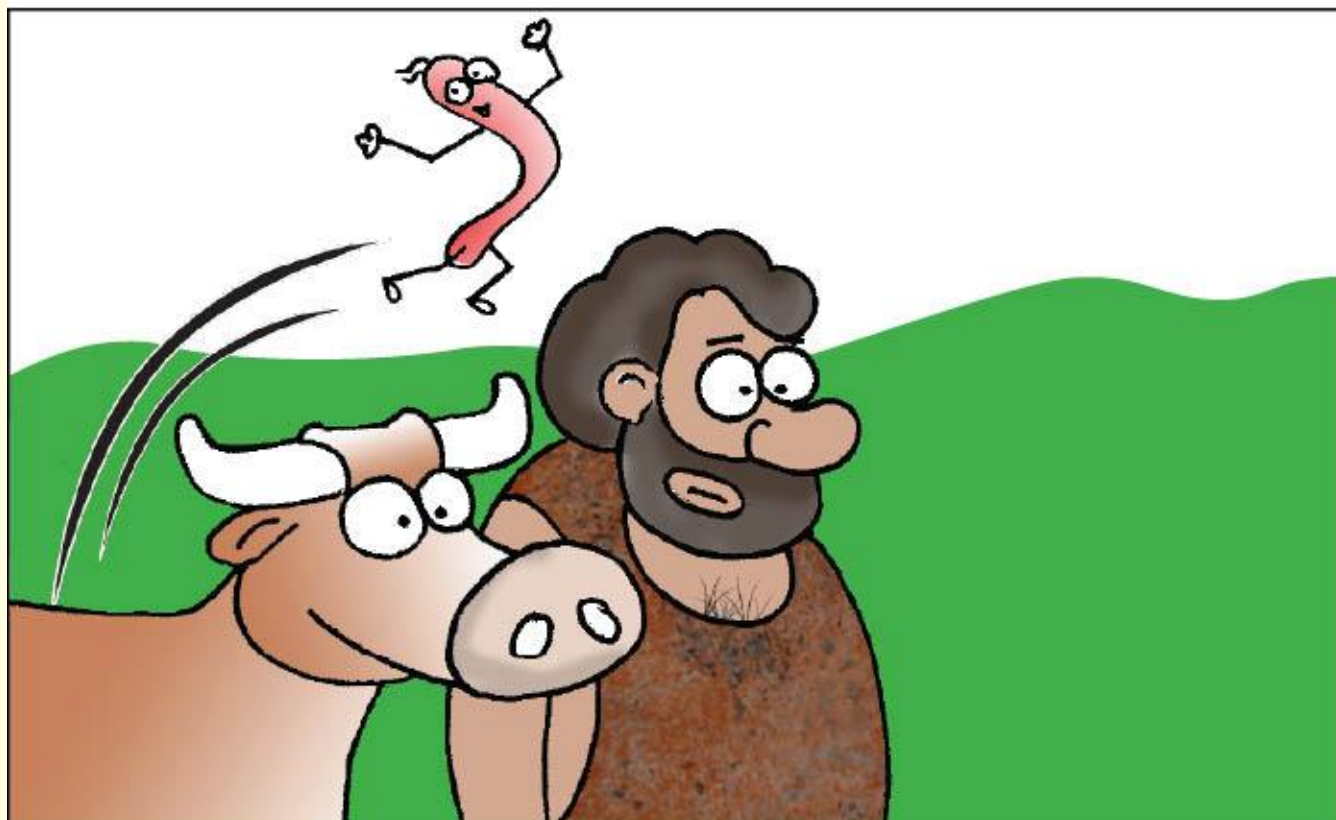
Illustrations by Bonny Starkey

Dr. Dominic Gaziano, MD  
November 19, 2015  
Charleston Marriott

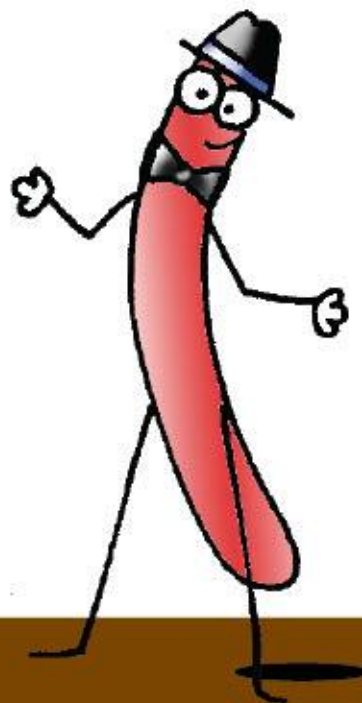


# Welch State Hospital Cafeteria





I'M TIRED OF LIVING IN THIS FIELD WITH THIS COW. LET'S JUMP ONTO THAT MAN SO WE CAN GO PLACES!



LET'S GO TO THE PARTY! NOBODY WILL  
RECOGNIZE US!







The Lord shall smite thee with a consumption, and with a fever, and with an Inflammation...and they shall pursue thee until thou perish.

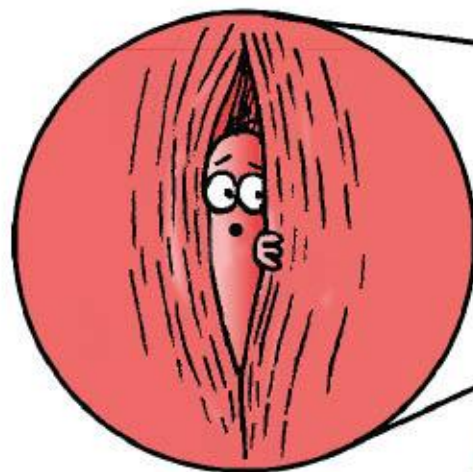
### Deuteronomy 28:22

- Named TB Phthisis (wasting).
- Describes the clinical disease that could be TB.
- Advised physicians not to visit terminal TB patients. This may diminish their reputation.
- TB was treated with honey, barley gruel, dark wine and herbs.

### Hippocrates

- Greek physician to three Roman Caesars.
- Believed there were two types of blood-from the liver and from the heart.
- Believed the lungs' function was to cool and warm blood.
- Popularized blood letting of ill rumors.
- Established chemical concoctions called galenicals.
- Treated phthisis with fresh air, milk, and sea voyages.
- Wrote extensively and influenced medicine until the 20<sup>th</sup> century.

### Galen



UH-OH, THEY'RE LOOKING INTO OUR HIDEOUTS!



# Science vs. Empiricism

## The Beginning of Scientific Inquiry

### Bologna and Padua (16<sup>th</sup> Century)

#### Astronomy

Copernicus (Poland)

Galileo (Italy)

#### Anatomy

Vesalius (Belgium)

Harvey (England)

G. Fracastoro (Italian) (1478-1553). Advanced infectious concept of tuberculosis – “seed like elements” that could transfer over distances.

Sylvius (Dutch) (1614-1672). Described tubercles that progressed into cavities and ulcers.

B. Marten (English) (1720). Advanced the theory of consumption in which he termed animalculae particles could pass from person to person.

19<sup>th</sup> Century Northern Europeans believed tuberculosis was inherited.

19<sup>th</sup> Century Southern Europeans believed tuberculosis was contagious.

Paganini and Chopin were kicked out of dwellings in southern Europe.

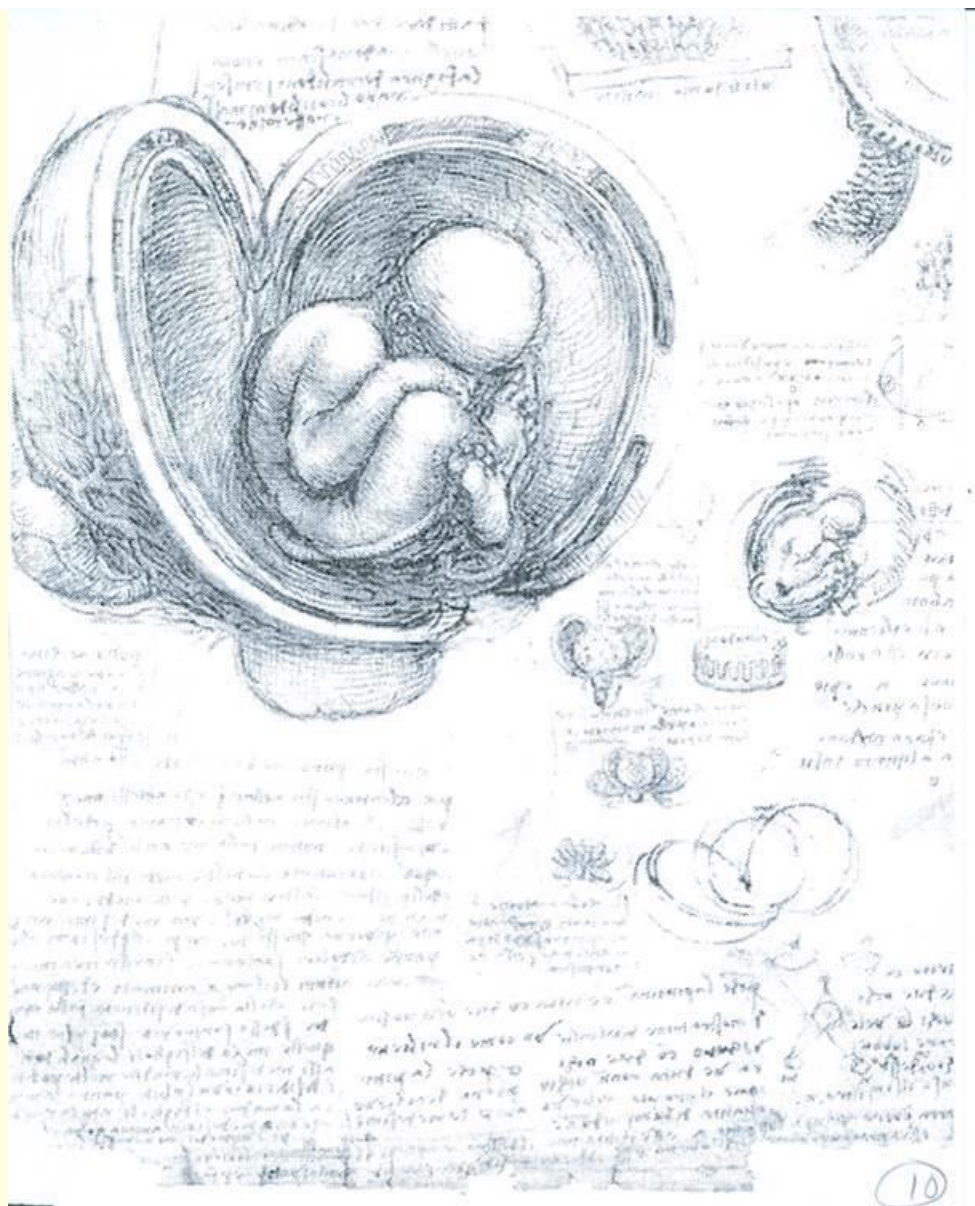
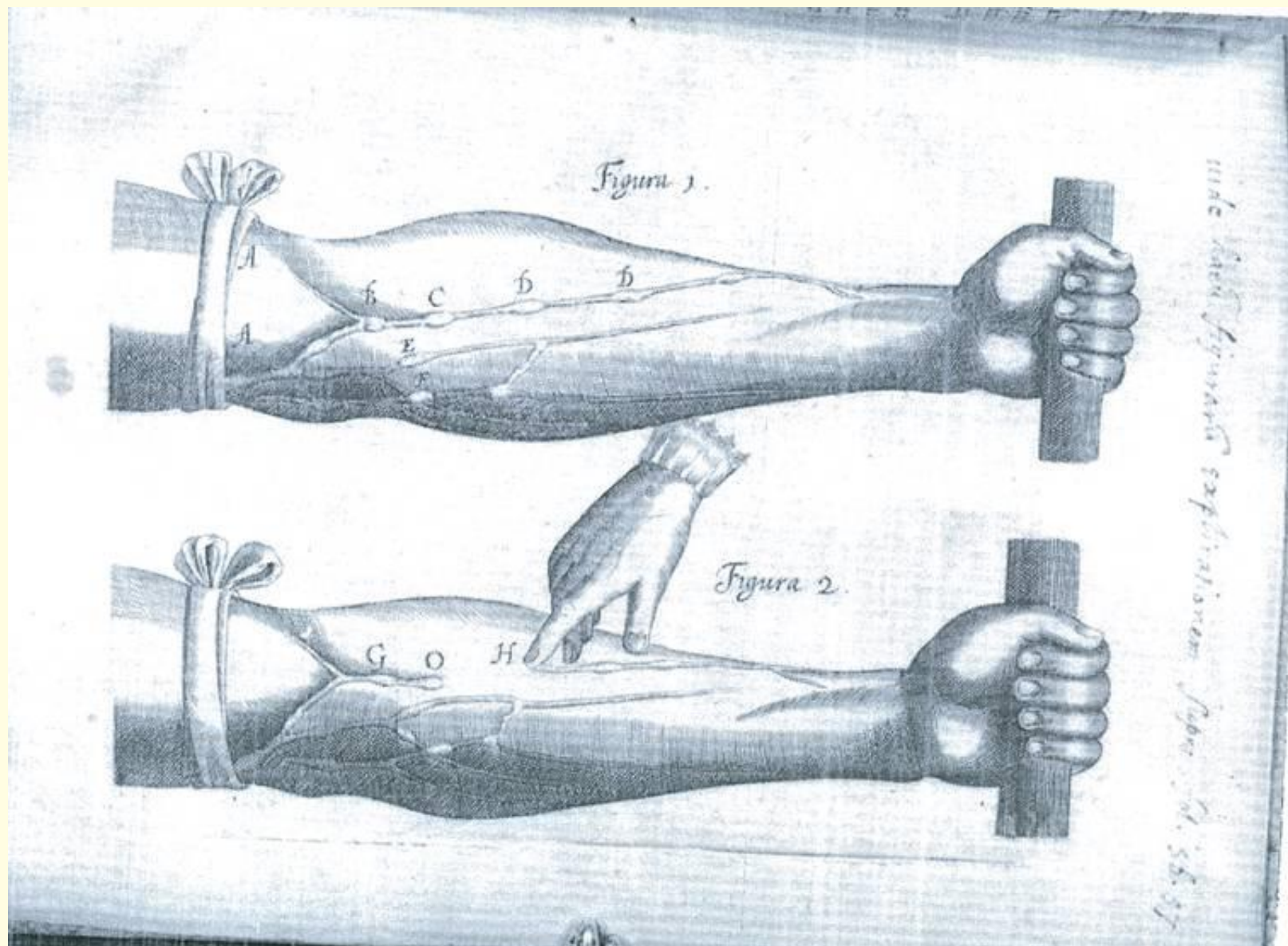




fig. 2. – Andreas Vesalius (1514–1564) as depicted in one of the plates from his masterpiece *De Humani Corporis Fabrica*.









**DON'T WORRY, THEIR CHEMICALS AND  
BLOODLETTING ARE MAKING OUR JOB EASIER!**

# Medical Treatments, 18<sup>th</sup> – 19<sup>th</sup> Century

Iodine  
Cod Liver oil  
Calcium phosphate  
Fresh blood  
Antimony tartarate  
Quinine  
Gas insufflation  
Warm breath of a healthy beast (horse)  
Leeches

*Ref: Dormandy, Thomas. White Death. New York Univ Press 2000, p 46-49.*

Phlebotomy  
Theriac (Galens mixture)  
Blindweed (cathartic)  
Mercuric oxide (emetic – purgative)  
Blessed oil  
Mercuric chloride (calomel)

*Ref: Eamon, William. The Professor's Secret.*

Laudanum (tincture of morphine)



*Holding a lancet between his teeth, a barber-surgeon prepares a woman for a bloodletting. The ancient practice was believed to draw corrupt matter from the body. At right, a physician indicates the proper vein to cut.*



1200?



1900





1960



2012





## The barbers' poles and the reasons for their colors



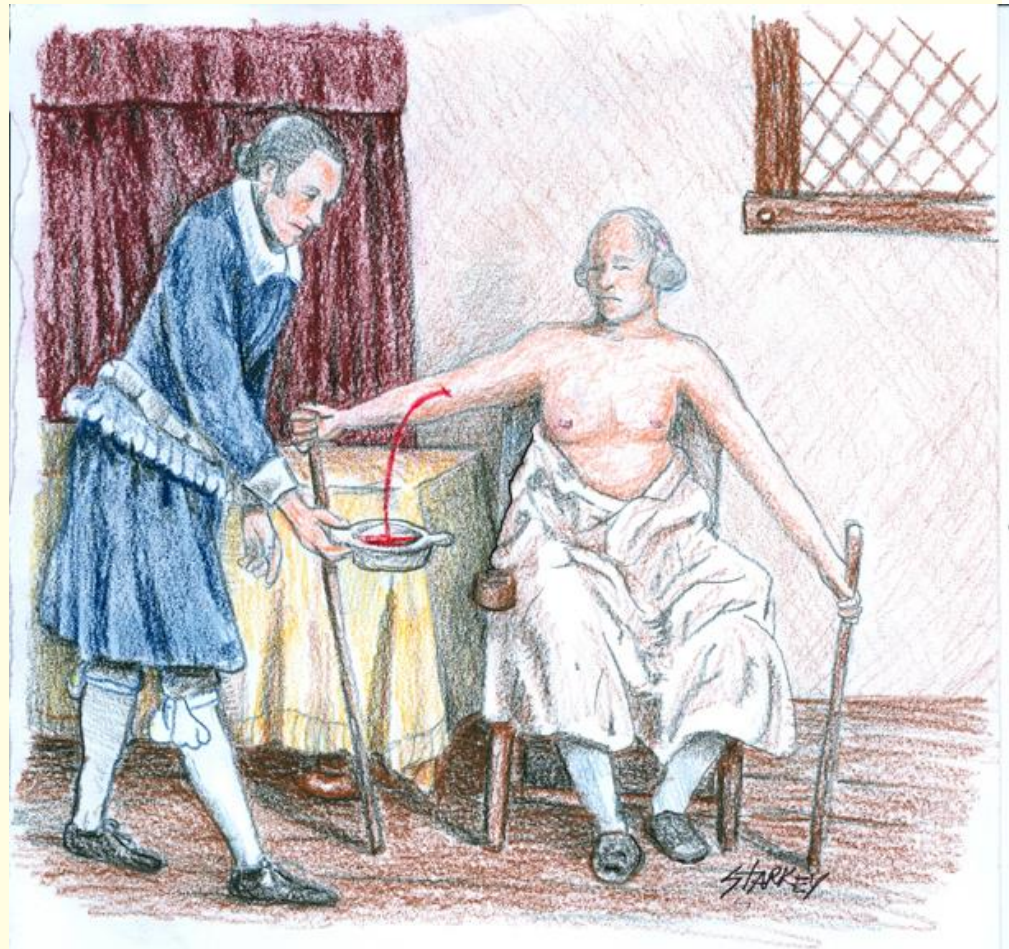
# The Death of George Washington

*By Tobias Lear*

Rawlins came in soon after sunrise.  
The general, observing that  
Rawlins appeared agitated said,  
“Don’t be afraid”...the incision  
Was made and the blood ran freely.

Dr. Craik came in soon after and put a  
blister of cantharides on his  
Throat and took some more blood  
from him.

Dr. Craik returned soon after. The  
general could now swallow a little.  
Calomel and tarter em were  
administered.



# Jim Olson's Essay on Abigail "Nabby" Adams



Modesty demanded that Nabby unbutton only the top of her dress and slip it off her shoulder, exposing the diseased breast but nothing else. Dr. Warren did not wash his hands. He sat her down, leaning back in a reclining chair. He belted her waist, legs, feet and right arm to the chair.

He thrust a two-pronged fork into her breast and, with a large razor, started slicing into the base of the breast. The tumor was larger than anticipated and he felt lymph nodes under her left arm. He razored in there as well. Nabby grimaced, groaned, flinched and twisted in the chair with blood staining her dress and Warren's shirt and pants.

To stop the bleeding, Warren pulled a red-hot spatula from the oven and cauterized the worst bleeding points. The whole procedure took less than 25 minutes. Abigail and Caroline helped Nabby pull her dress back over her shoulder as modesty demanded.

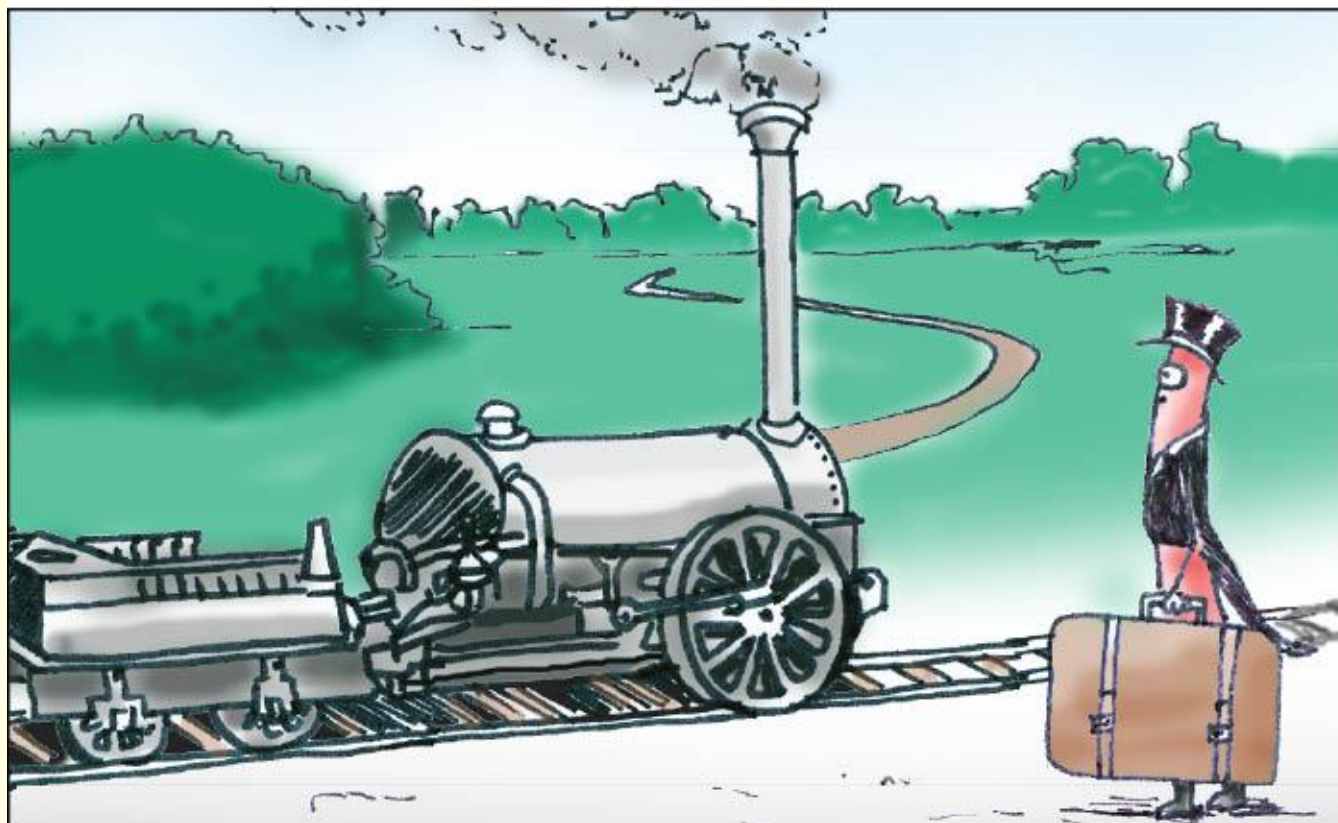


LES AMIS.

32



— Mon cher je t'assure que je te trouve mauvaise mine ce matin .... ce n'est pas en médecin que je te parle, c'est en ami .... je veux absolument te soigner .... mieux que je ne me soignerais moi-même .... je vais t'appliquer trente sangsues à l'épigastre, et si demain matin je ne te trouve pas plus robuste, je t'en réappliquerai soixante ! ....



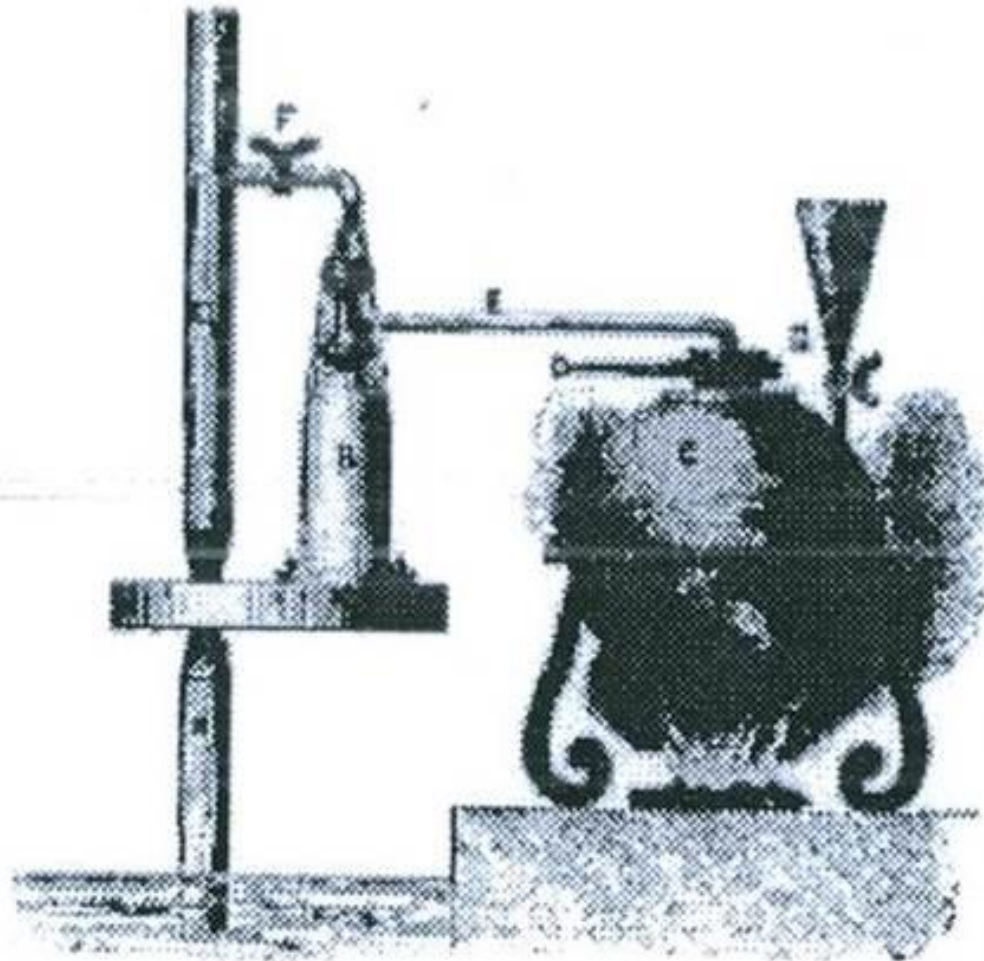
I WANT TO GO TO THE CITY AND SEE THE  
LIGHTS.



# TB: Major Cause of Suffering and Death

- One Billion deaths in the 19<sup>th</sup> Century
- During 20<sup>th</sup> Century, TB killed~ 100 million
- England 1815: 1 in 4 deaths
- France 1918: 1 in 6 deaths
- Major cause of death in the U.S. in 1911

## Inventors: Thomas Savery,



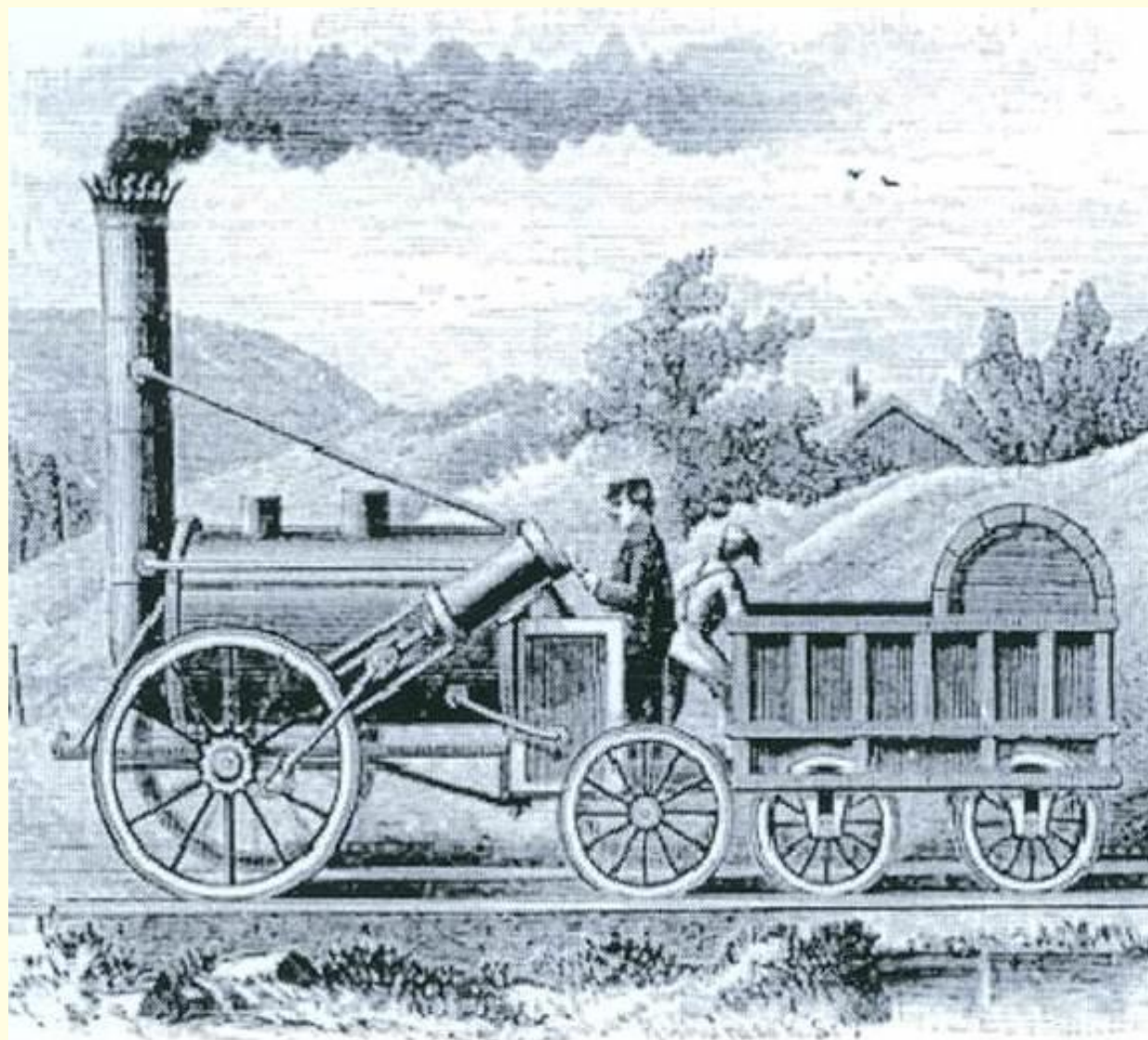
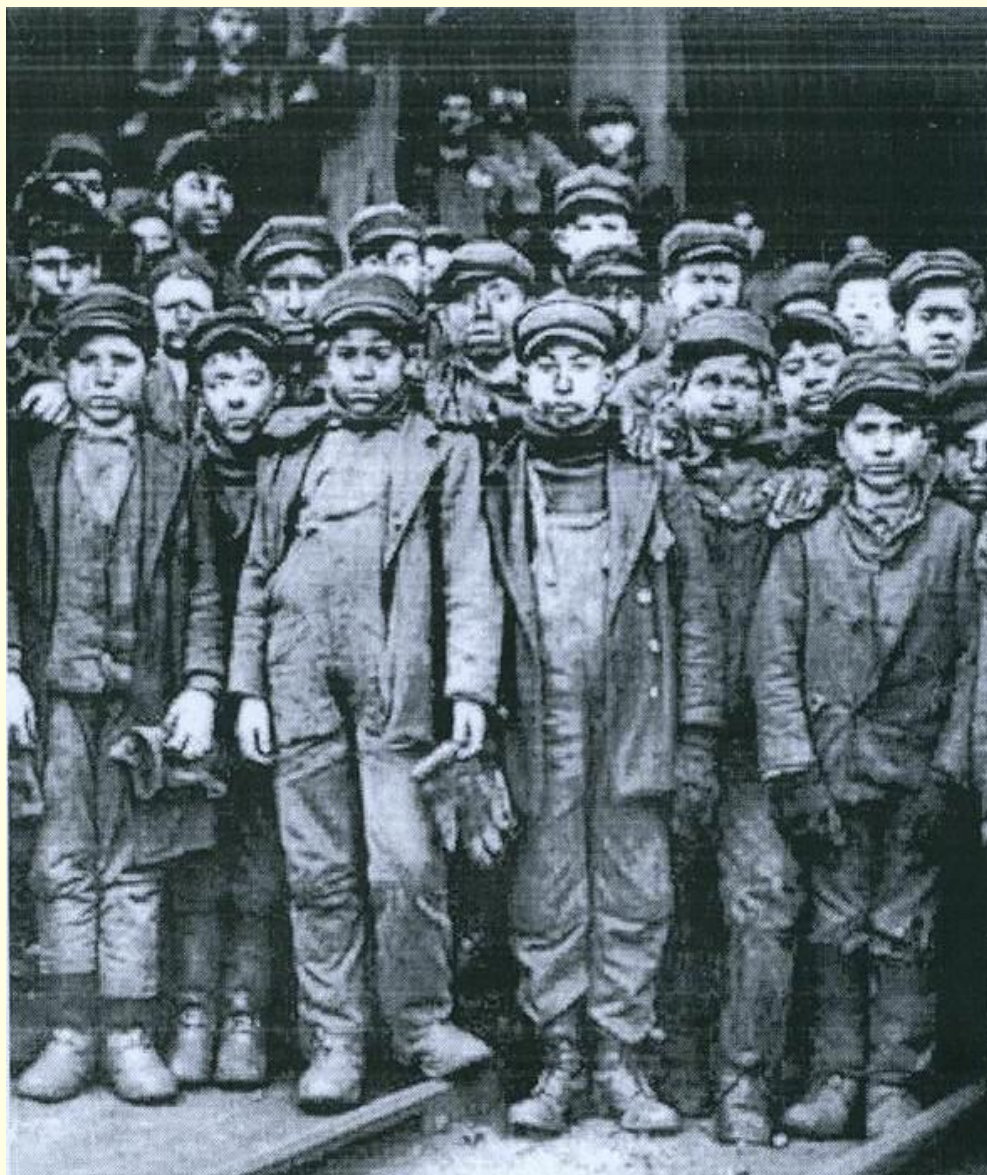


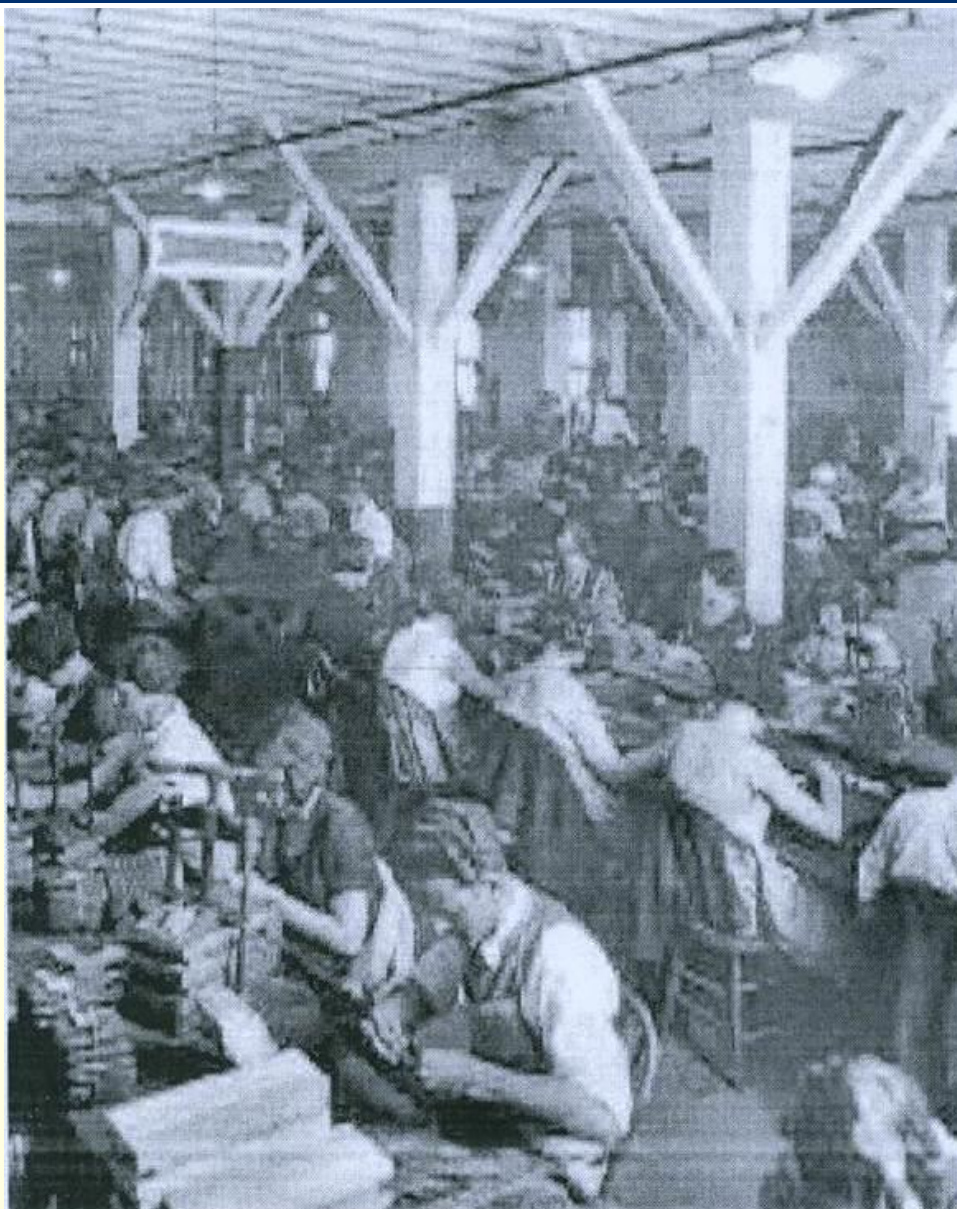
FIG. 153.—The "Rocket," 1829.

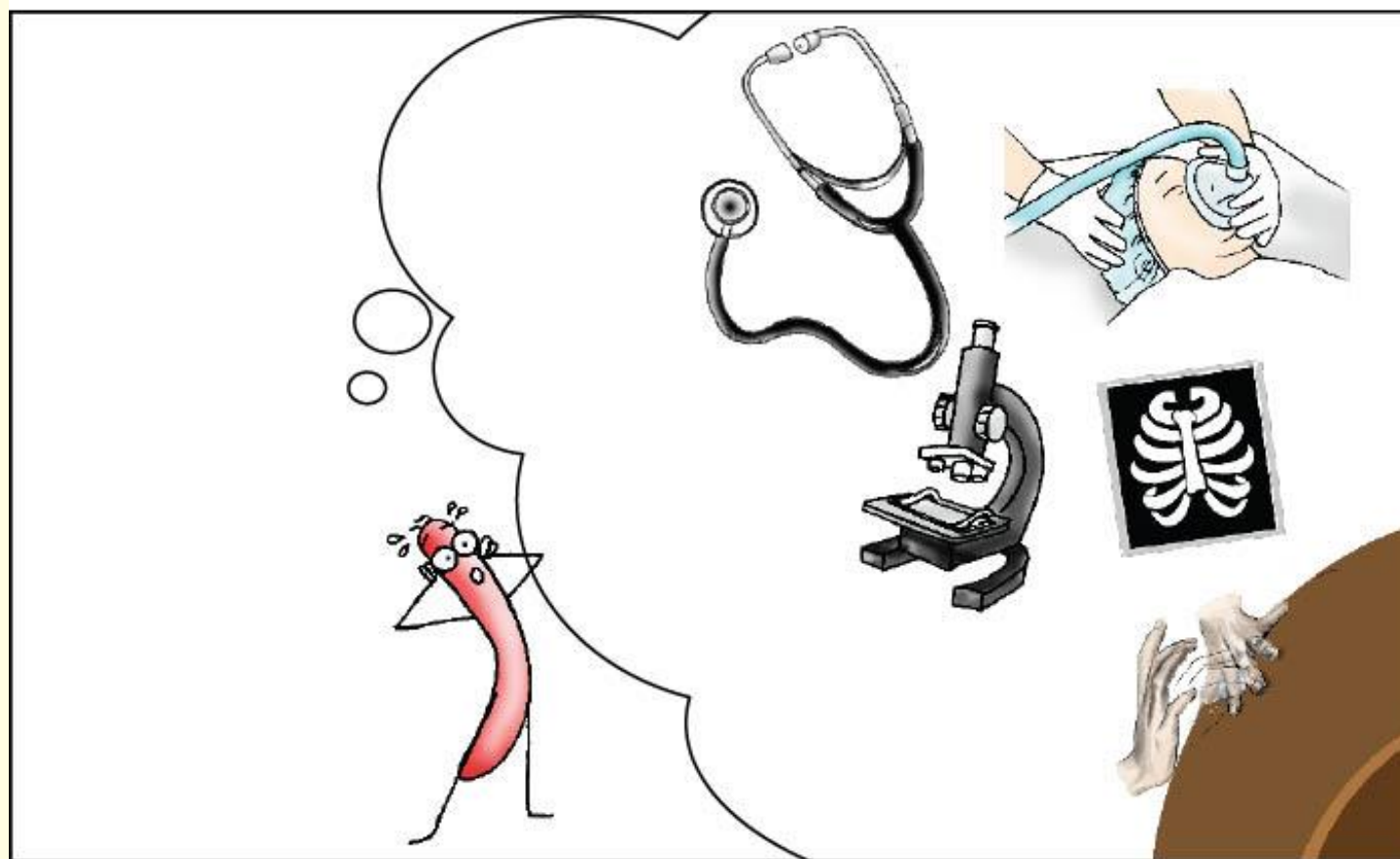






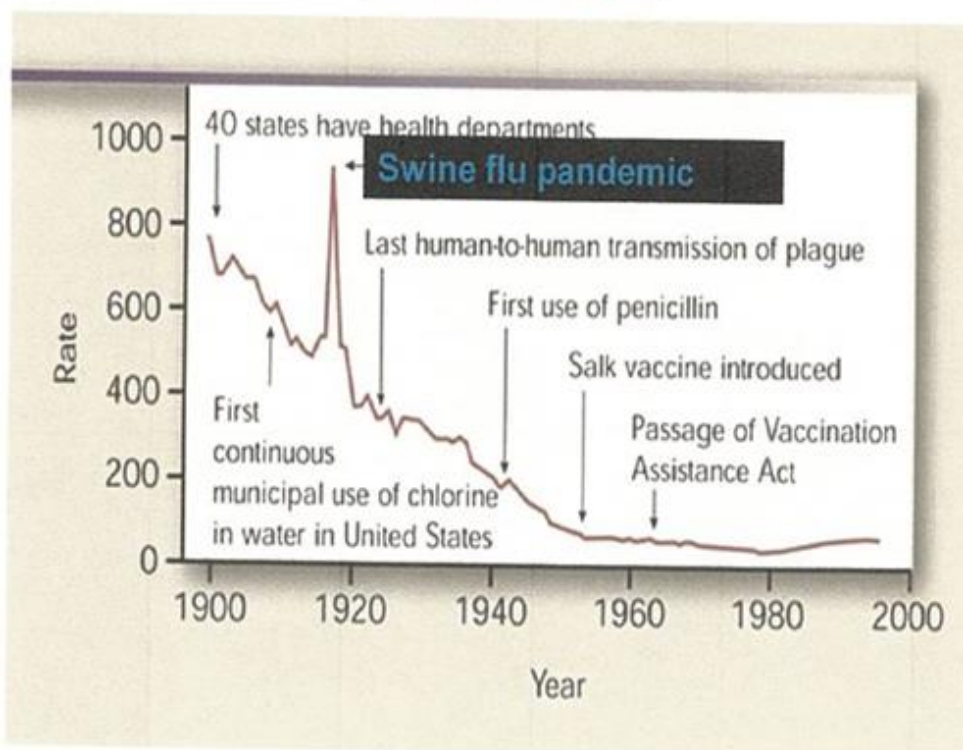






LOOKS LIKE WE ARE FOUND OUT! BUT DON'T  
WORRY, THEY STILL DON'T SEE US.

## Decline in Mortality due to Infectious Disease, United States, 1900-1996



# Edward Jenner

- “Milkmaids skin”
- Vaccination





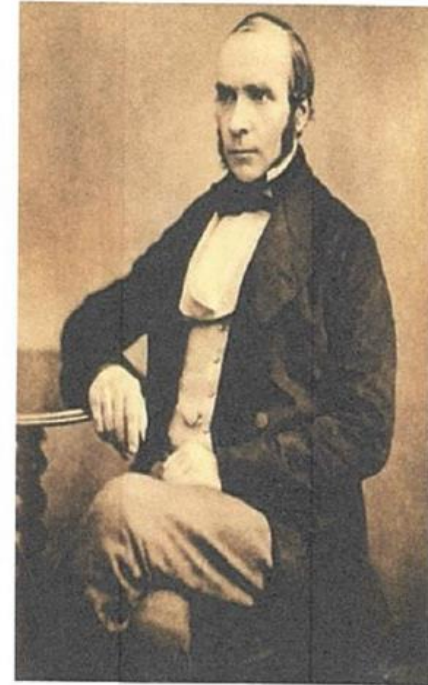
# Ignaz Semmelweis

- Purpural sepsis in maternity wards
- Hand washing



# Cholera: John Snow

- London physician to poor
- Studied cholera outbreaks in 1830s
- Symptoms: fever, pain in stomach, diarrhea.



- Cholera is again a problem in London 1848-1854
- Snow conducts a landmark series of studies which:
  - a) test his hypothesis about mode of transmission
  - b) lead to an intervention

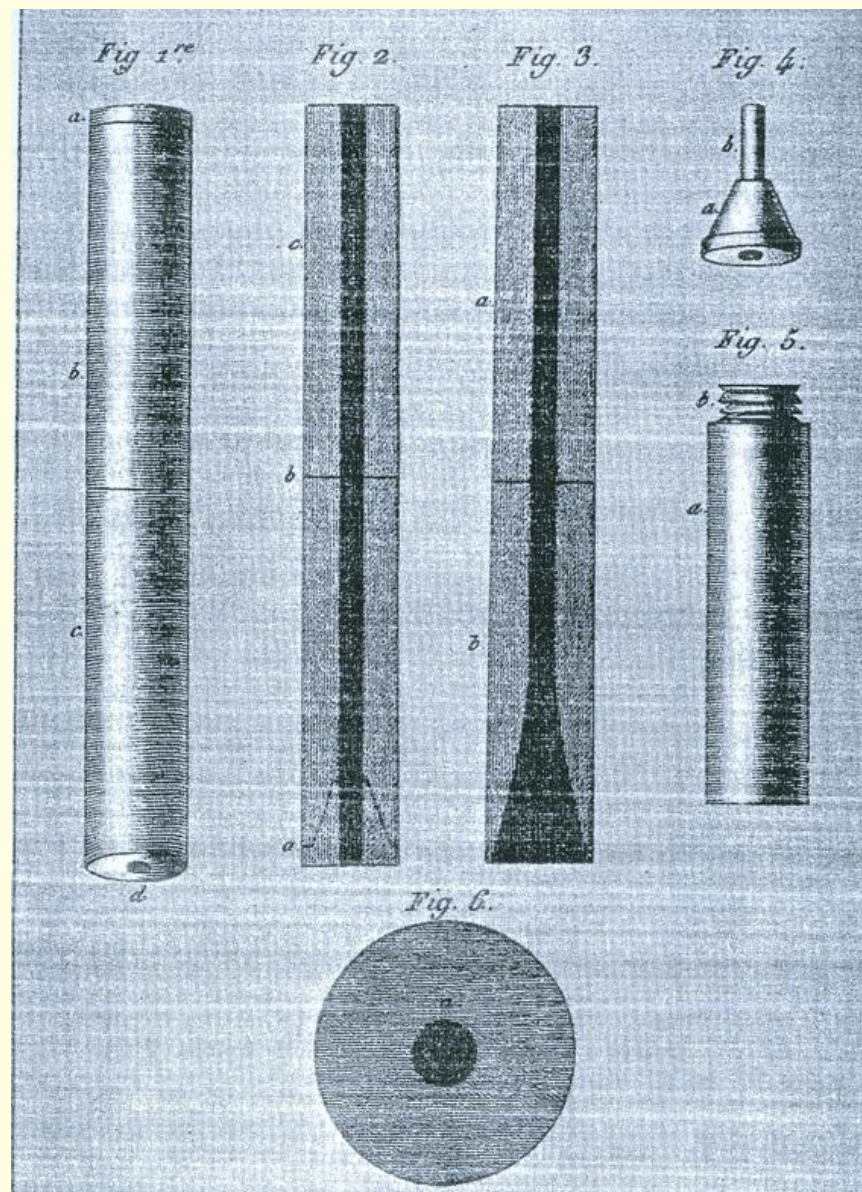
# Epidemiologist Pilgrimage to the Broad Street Pump



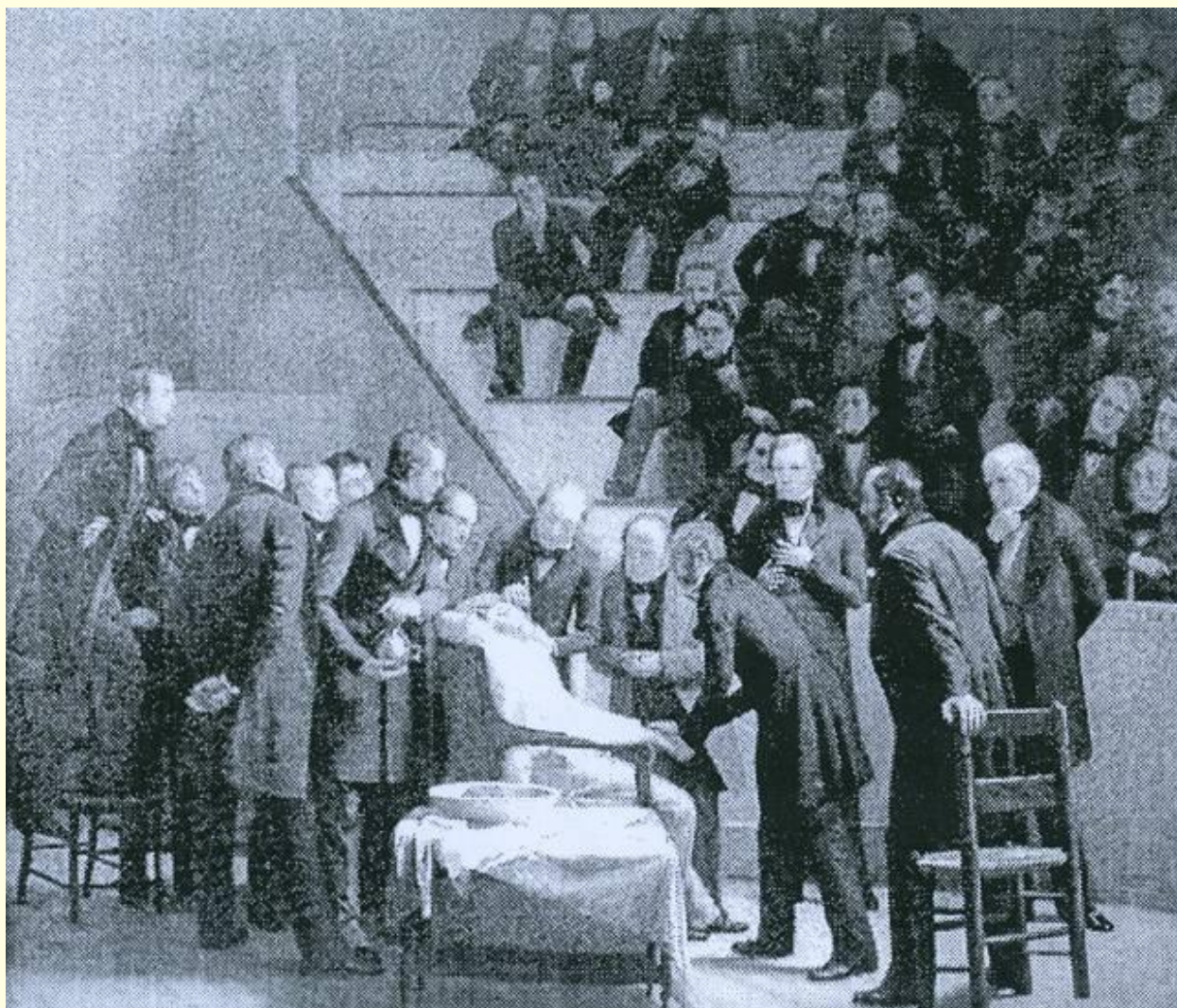
# Advances in the 19<sup>th</sup> Century

- **Microscope invented by Van Leeuwenhoek (Dutch)**
- **Bichat, (French) in 1802, used the microscope in describing morbid anatomy**
- **Auenbrugger (Austrian) described diagnostic percussion**
- **Laennec (French) invented the stethoscope**
- **Schoenlein (Swiss) describes the fundamental pathology of tuberculosis**
- **Long or Morton (American) developed clinical anesthesia**
- **Roentgen (German) discovered x-ray**









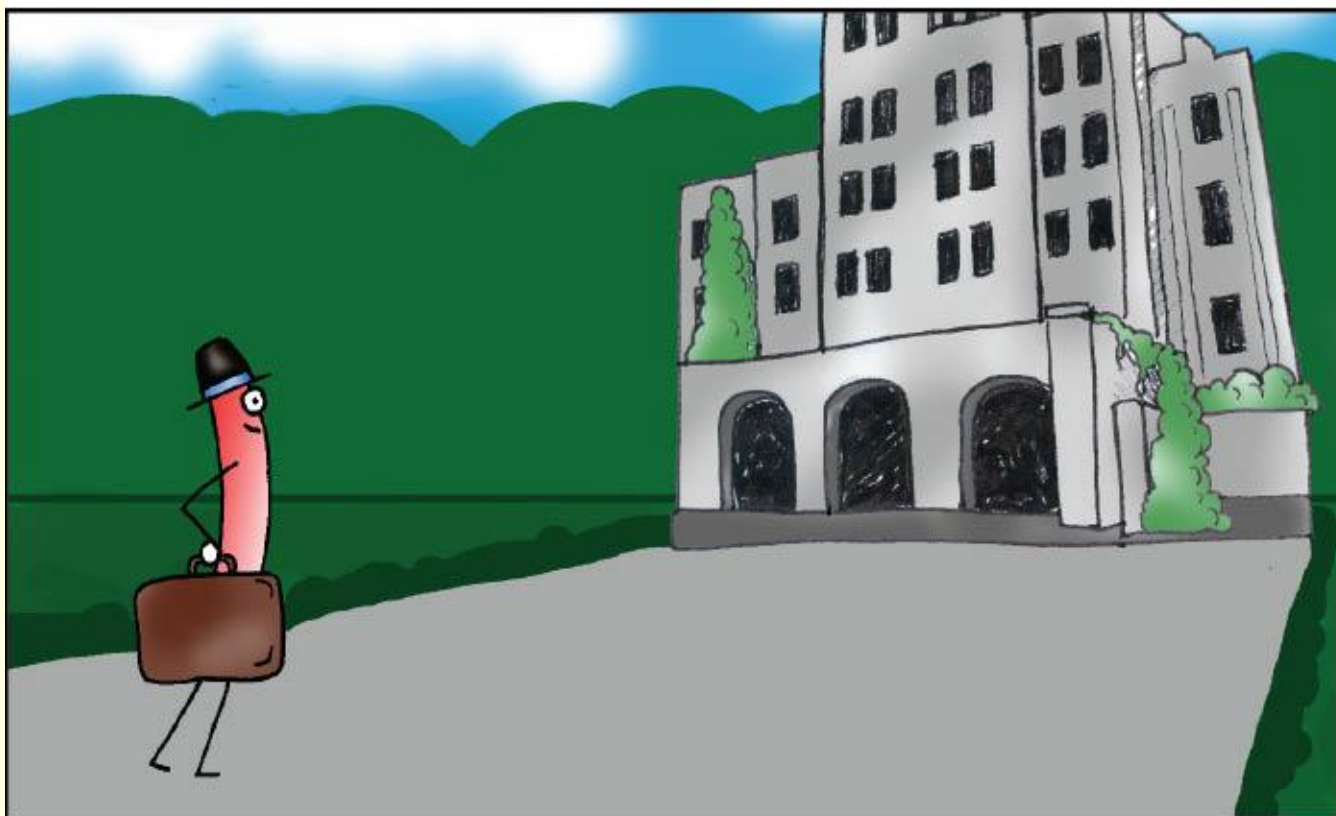
# Chest Radiograph

- Abnormalities often seen in apical or posterior segments of upper lobe or superior segments of lower lobe
- May have unusual appearance in HIV-positive persons
- Cannot establish or confirm diagnosis of TB



Arrow points to cavity in patient's right upper lobe.





OH, GOODY! WE GET TO GO TO THE RESORT!

# Sanitorium

- 1840** George Bodington proposed a hospital for tuberculosis in England
- 1854** Herman Brehmer, a German, established the first TB sanatorium
- 1885** Edward L. Trudeau founded the first TB sanatorium in the U.S.
- 1942** The United States had 100,000 sanatorium TB beds

## 1943 – Major TB Sanatoria Total 1300

### Inpatient Facility:

- Hopemont in Terra Alta
- Pinecrest in Beckley
- Denmark in Hillsboro

### Smaller Local Centers:

- Charleston
- Morgantown
- Ohio County
- Weston State Hospital



# Tuberculosis and Medical Science

## TUBERCULOSIS AND MEDICAL SCIENCE

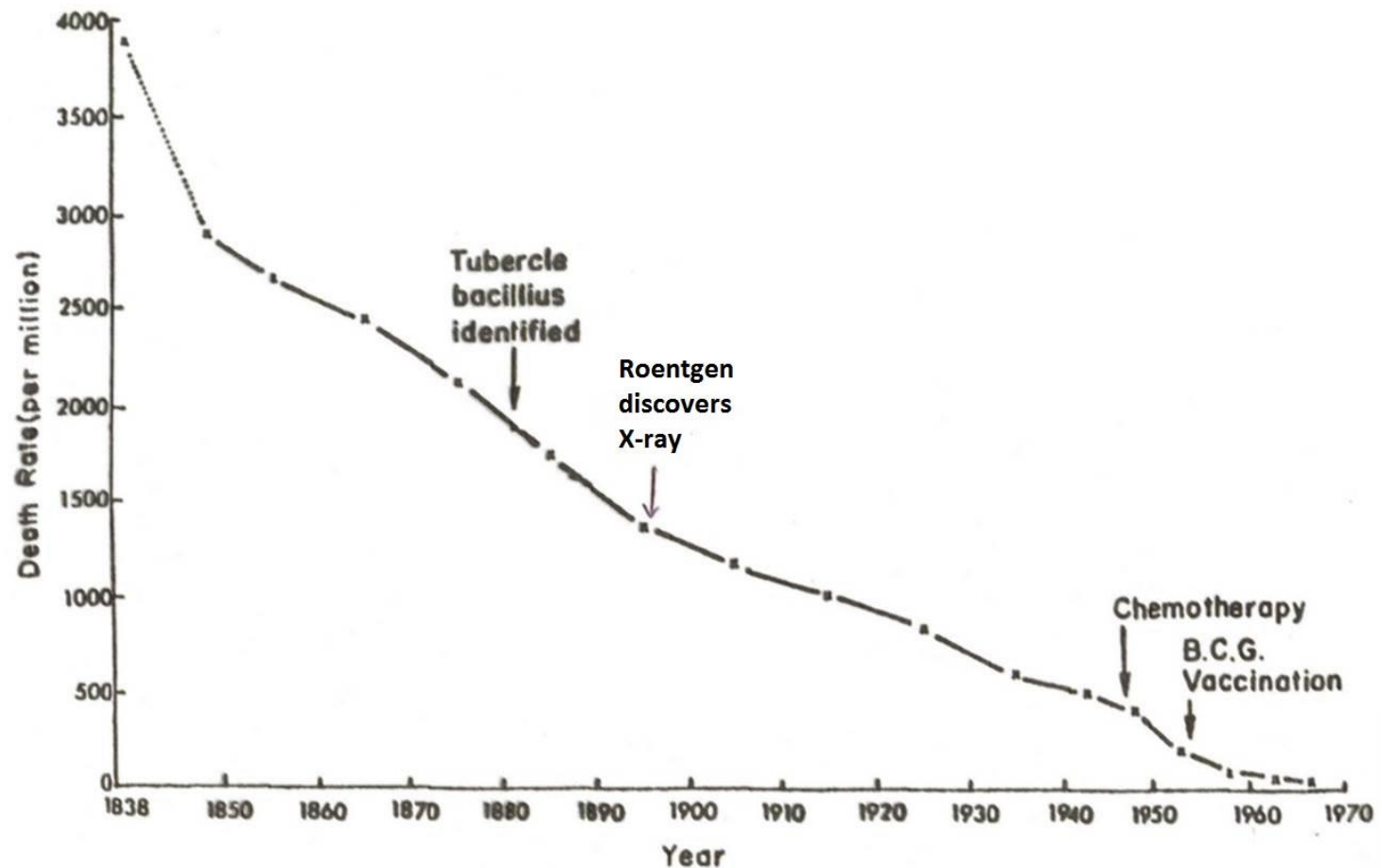


Fig. 1. Respiratory tuberculosis: mean annual death rate, England and Wales. (Reproduced with permission from McKeown T, Lowe CR. *An Introduction to Social Medicine*. Oxford: Blackwell, 1974.)

# Cause of Decline in TB (Pre-Antibiotic Era)

## **Environment:**

T. McKeown. Improvement in Housing and Nutrition.

Hoffman, F. L. Housing, Nutrition and Abolishment of Child Labor.

Dubois, René. The White Plague.

## **Public Health Measures:**

E. Long. Treatment and Public Health Measures

U.S. Public Health Service 1957: Treatment and Public Health Measures.

## **Natural Immunity:**

Generational Acquired Residual Resistance.  
Mini epidemics

Irish-German migration Chicago, 1860

African-American migration to southern cities, 1880

Indian-Mexican migration, Southeast U.S., 1910

Chinese-Japanese migration, West Coast after WWII

Grey, ERN. The Arcana of Tuberculosis. Am. Rev. Respir. Dis. 1958

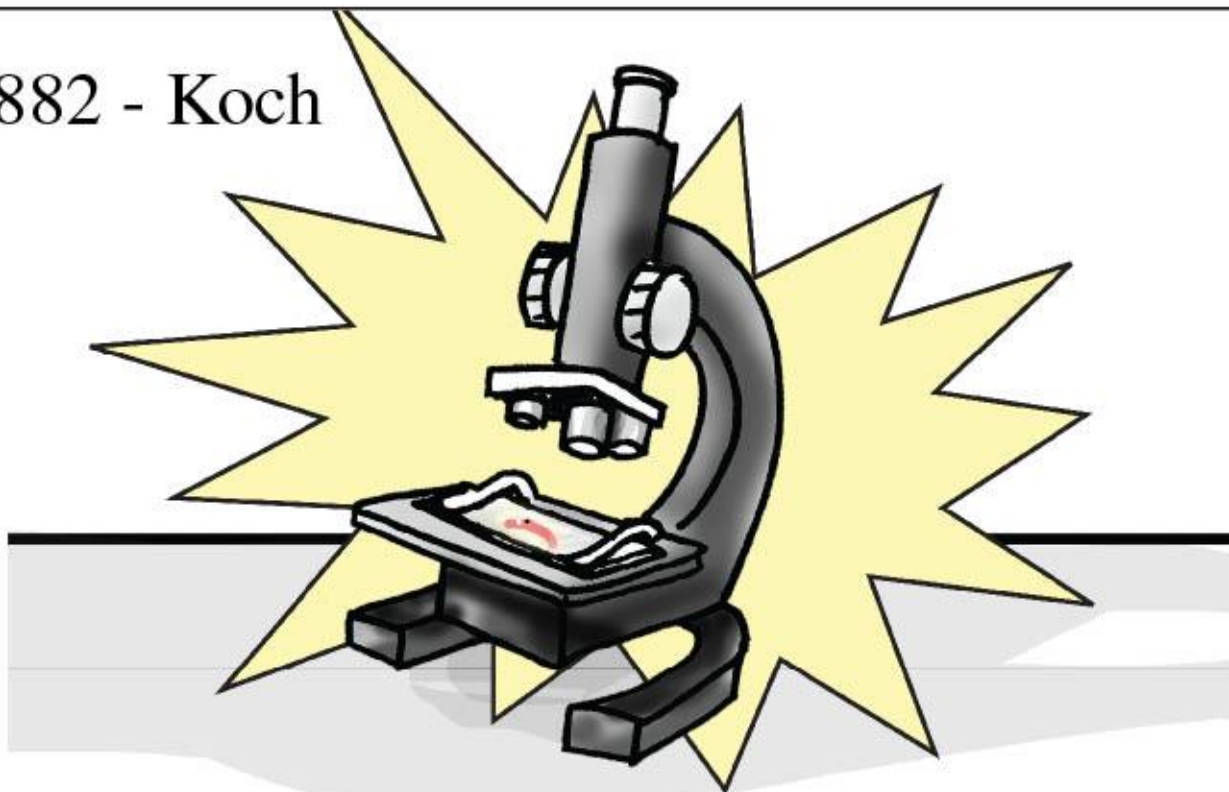
## **NOTES: MMWR, March 25, 2011. Incidence of TB in Ethnic Groups in the U.S. in 2010**

Hispanic x 7

African American x 8

Asian x 25

1882 - Koch



**BLAST! WE ARE DISCOVERED!**



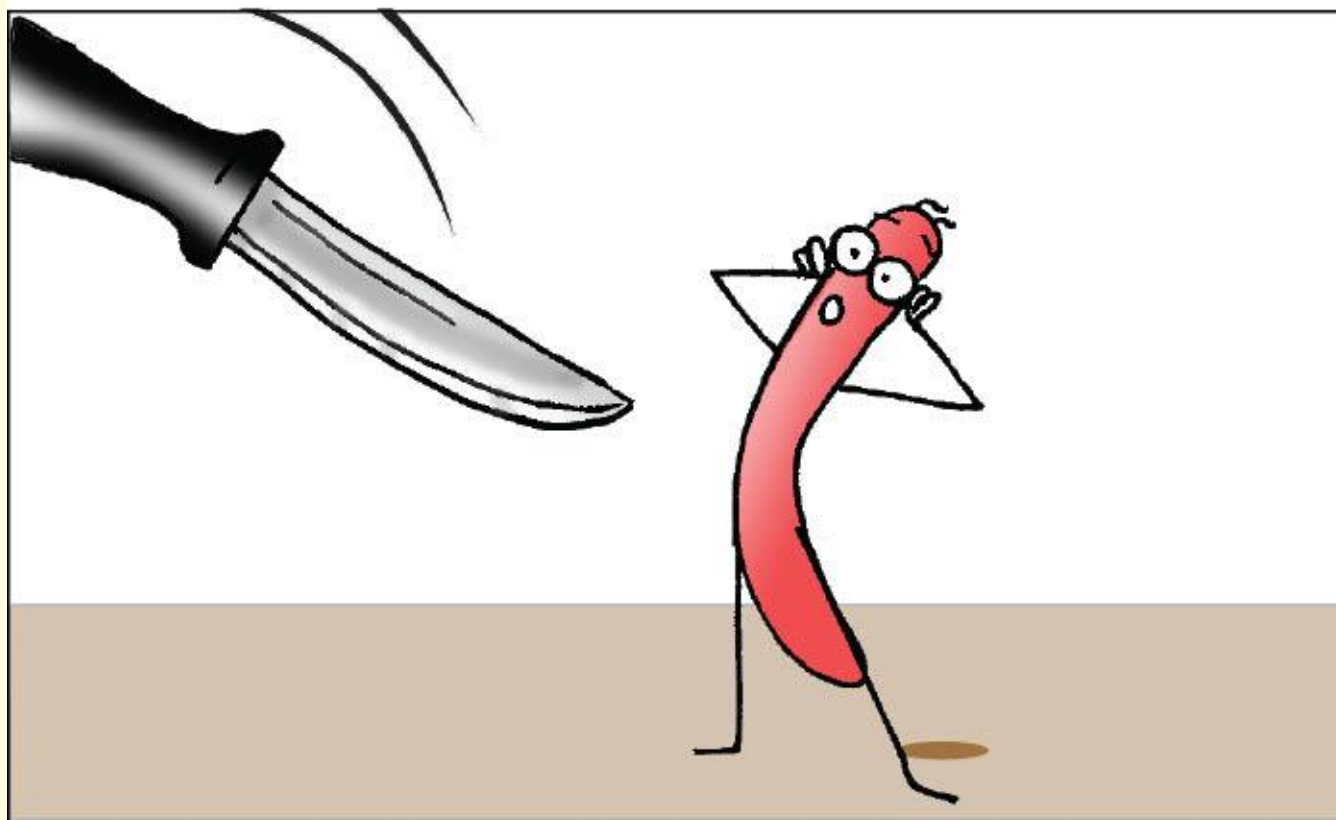
# Establishment of Tuberculosis as an Infectious Disease

Villemin, J.A.: A military surgeon who transferred tuberculosis from infected patients to rabbits with the use of controls, conceived after observing the transfer of the horse disease "glanders" to humans.

Koch, R.:

- Established Koch's Postulates regarding infection.
- He cultured TB.
- He stained the TB germ.
- He developed Tuberculin for later use in skin testing.
- He erroneously thought Tuberculin could be used as treatment.
- He erroneously stated that bovine tuberculosis was not contagious.
- He received the Nobel prize for medicine twenty-five years after his discovery of the cause of tuberculosis.





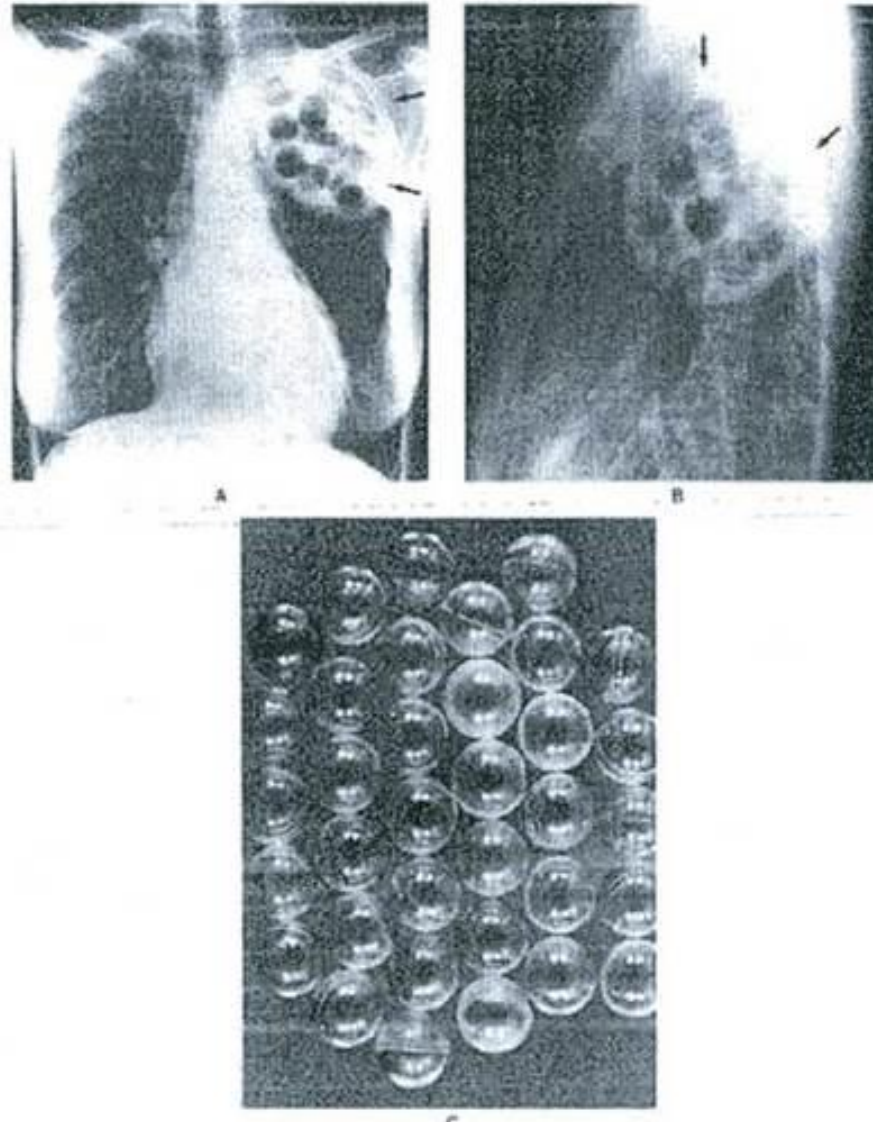
HEY, THEY'RE COMING AT US WITH A KNIFE!

# Surgery in Tuberculosis

- **Pneumothorax and pneumoperitoneum**
- **Phrenic nerve interruption**
- **Lucite balls or wax implants**
- **Thoracoplasty**
- **Pulmonary resection**



# Lucite-Ball Plombage

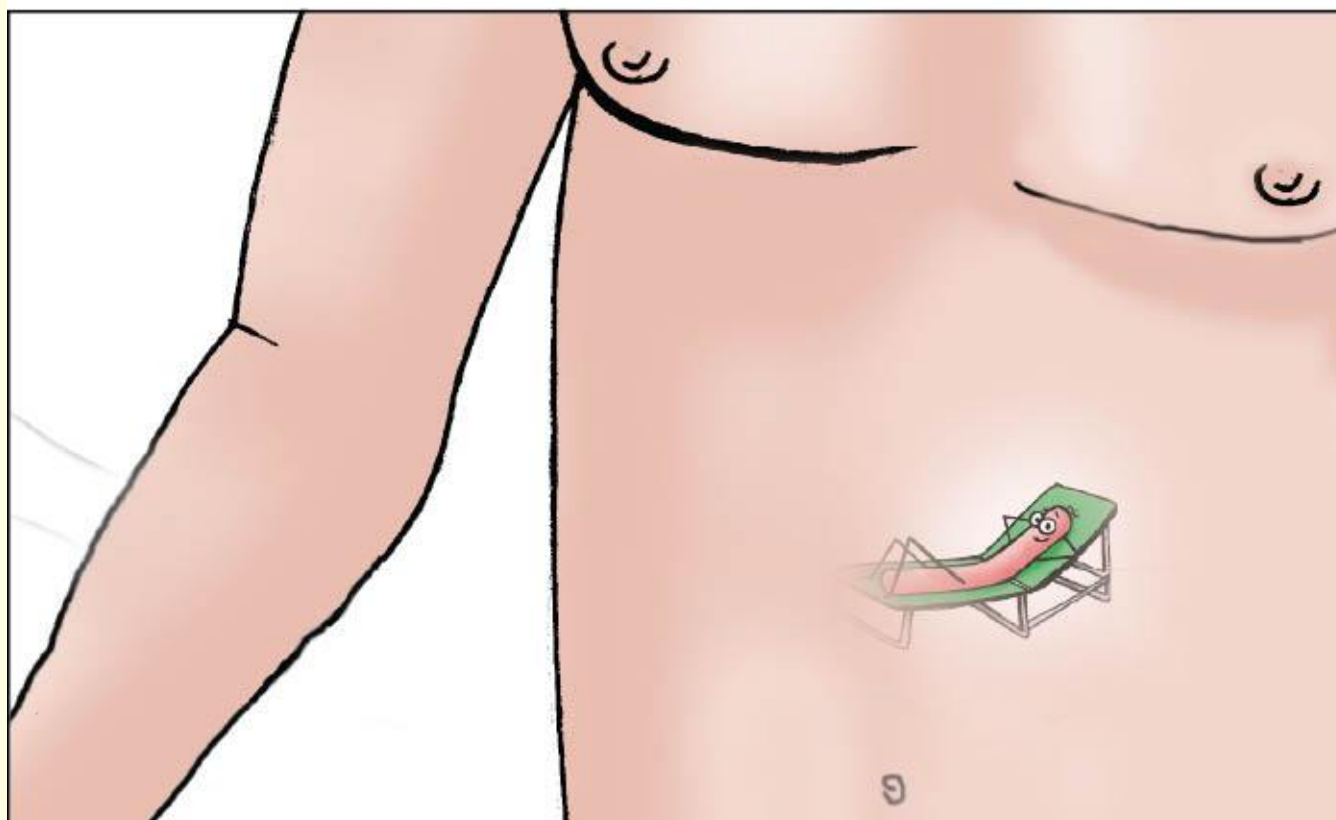


# JAMA<sup>®</sup>

June 8, 2005

The Journal of the American Medical Association



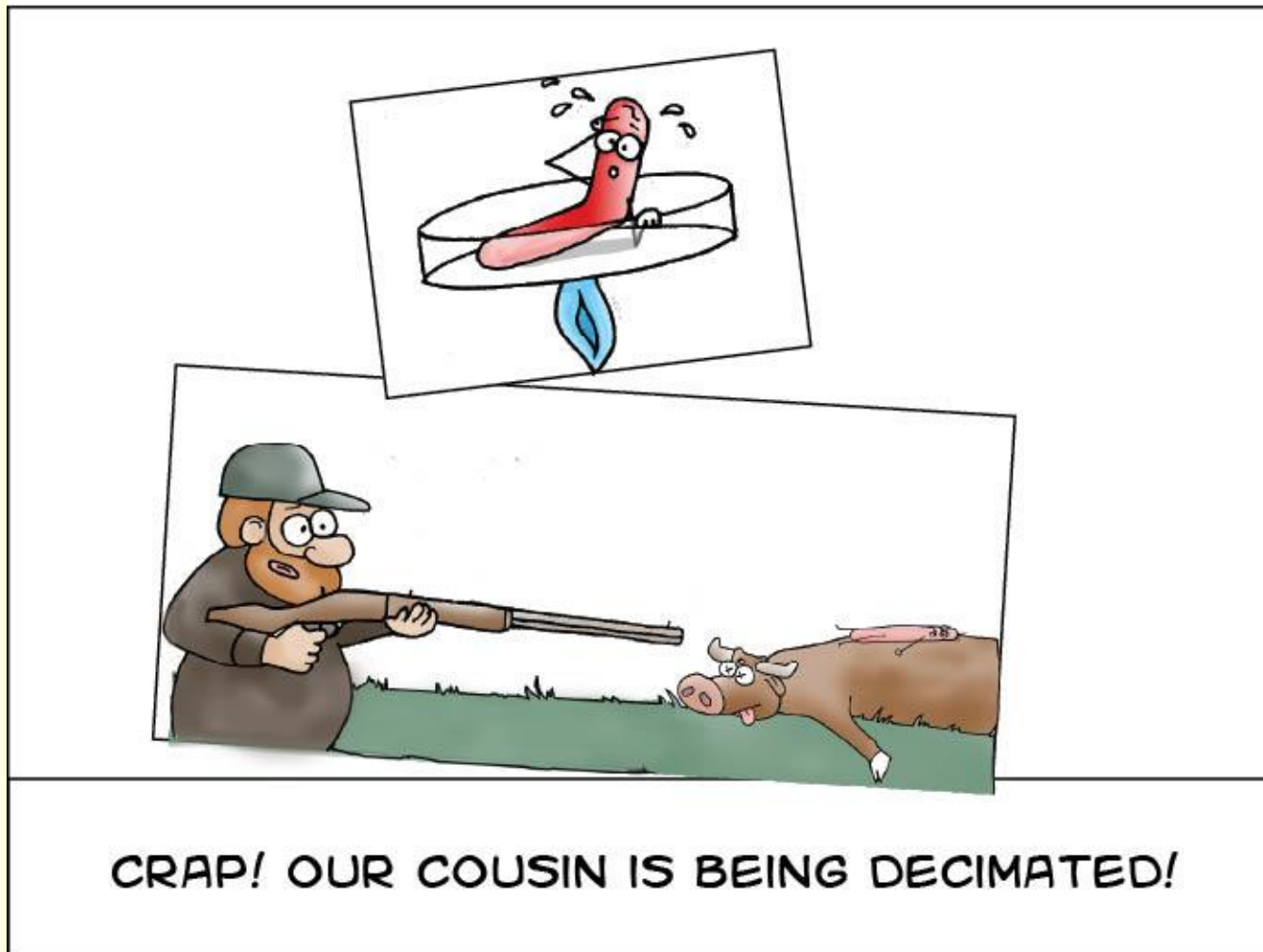


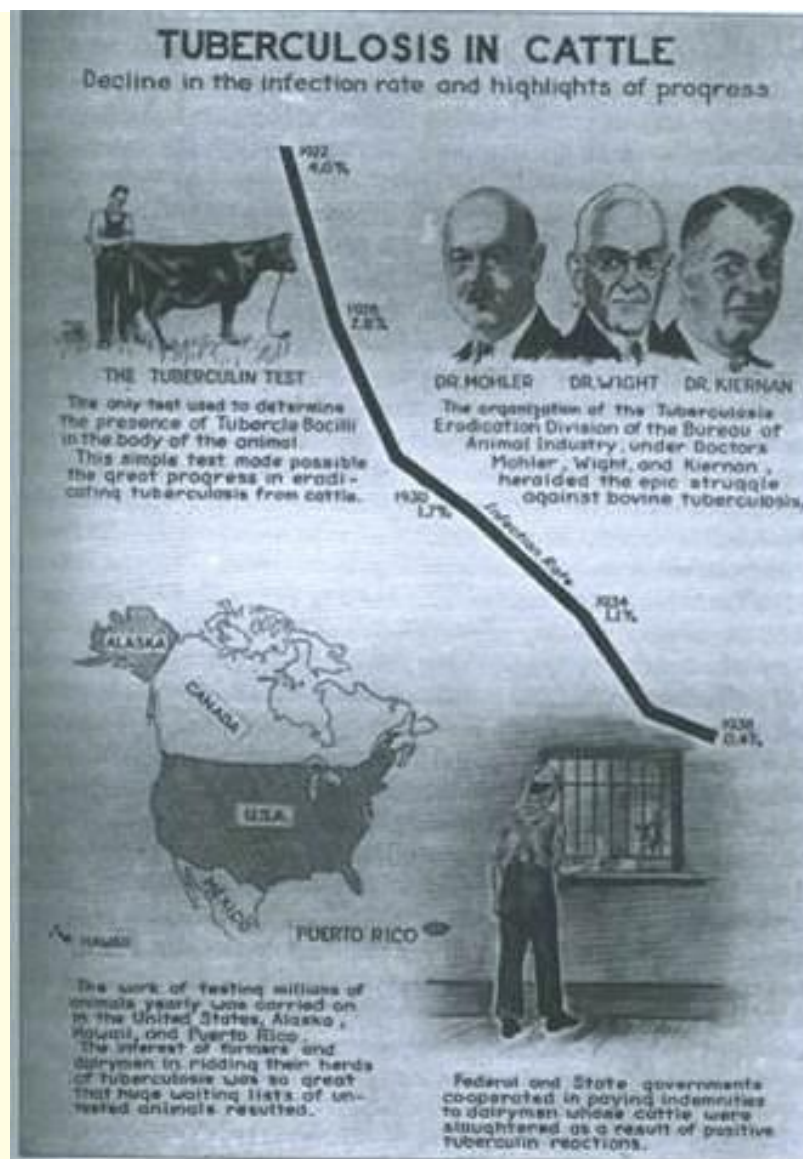
IMMUNIZATION/SMUNIZATION...DON'T THEY  
KNOW I CAN LIVE 100 YEARS IN THE BODY?

# Tuberculosis Vaccination

- Attenuated mycobacterium bovis for immunization developed by Calmett and Guerin.
- BCG vaccine trials summarized twenty-two studies reported in the Review of Infectious Disease, 1989.11. There was -20 to +80% protection.
- New vaccines slow in development. New prospect is Aeras-402 is a booster to lymphocytes and an adjunct to BCG.  
Am J Resp Crit Care Med, vol 181 pp 1407. 2010.



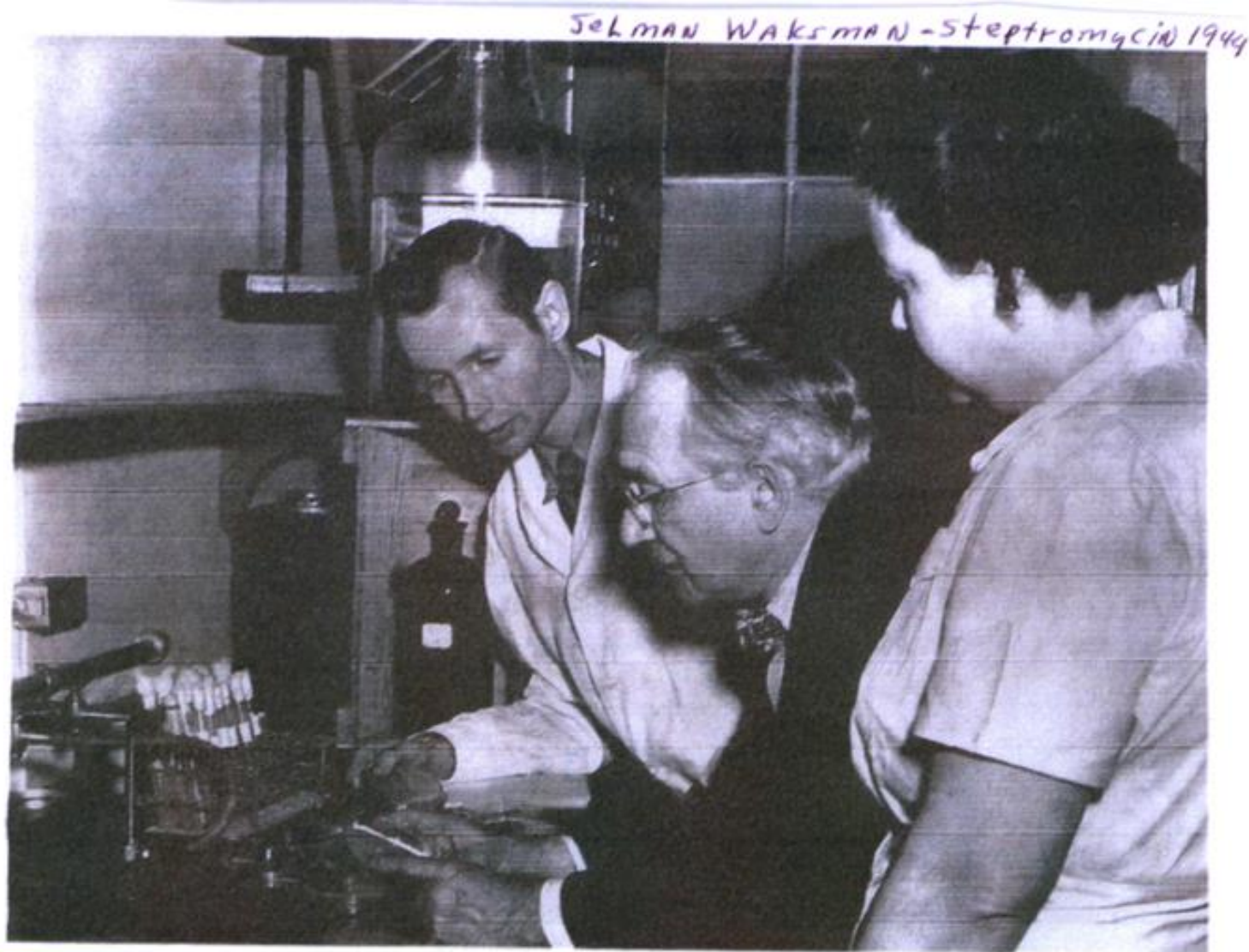




Tuberculosis in Cattle: A Success Story. Poster issued by the United States Federal Department of Health in 1939. The curve over the period 1922 to 1938 in Britain would have shown a steady upward rise.



YIKES! THEY FOUND A POISON!





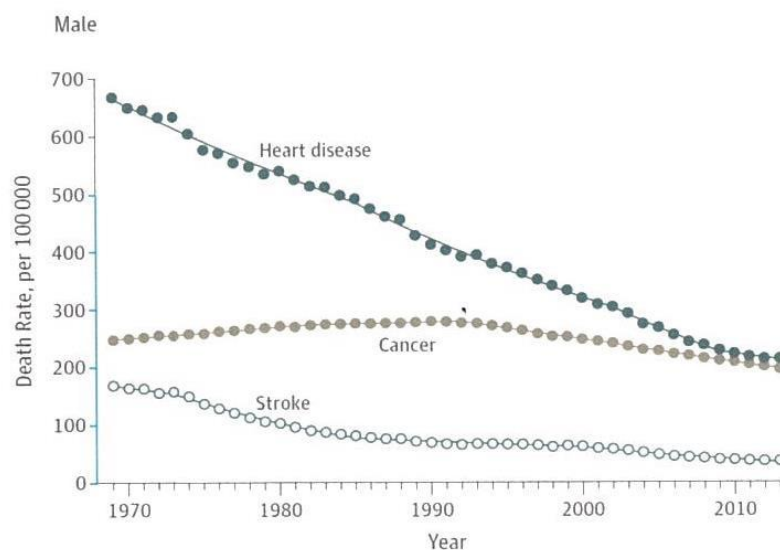
# Antibiotic Treatment of Tuberculosis

- 1943: Selman Waksman and Albert Shatz discover Streptomycin.
- 1944: Corwin Hinshaw and William Feldman do clinical trials with Streptomycin.
- 1946: Jorgen Lehmann discovers para amino-salicylic acid.
- 1946: Numerous reports of resistance developing to streptomycin and P.A.S.
- 1949: Gerhard Domagk of Bayer lab simultaneously with Squibb and Hoffman-LeRoche discover Isoniazid.
- 1949: William Stoenhen, Jr. explains the principle of acquired drug resistance.
- 1957: JOHN CROFTON ESTABLISHED THAT IF TUBERCULOSIS IS TREATED WITH THREE DRUGS UNDER SUPERVISION FOR EIGHTEEN (18) MONTHS TB IS CURED WITHOUT RELAPSE OR THE DEVELOPMENT OF RESISTANCE. "TB WAS 100% CURABLE".

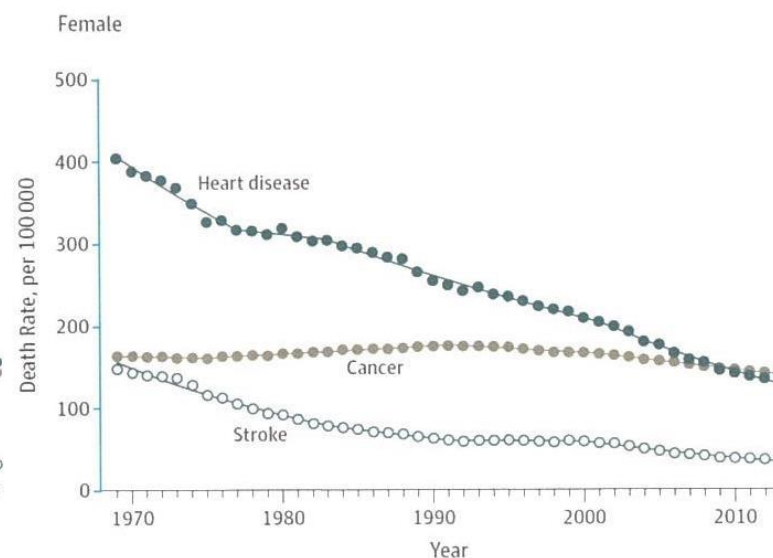
# Antibiotic Treatment of Tuberculosis (cont.)

- **1948:**           **Oxford first controlled study done was for streptomycin treatment of TB.**
- **1948:**           **Framingham population study**
- **1952:**           **British physician health study**  
                          **American physician health study**  
                          **American nurses health study**
- **Current:**       **One million man VA health study**

## Age-Standardized Death Rates by Sex and Cause of Death in the United States, 1969-2013.



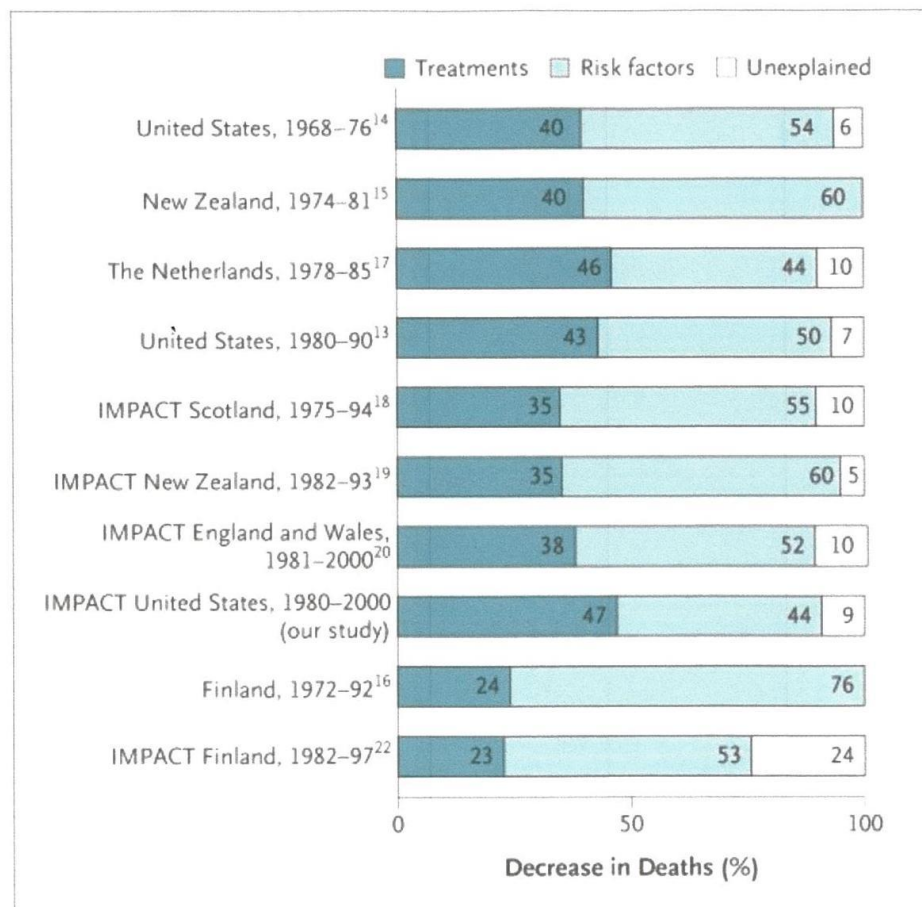
3% per year



2.5% per year

Source: Ma J, Ward EM, Siegel RL, Jemal A. Temporal trends in mortality in the United States, 1969-2013. *JAMA*. 2015;314(16):1731-1739.

## Proportional contributions of treatments and risk factor changes to CHD mortality across countries







THEY'RE CLOSING DOWN OUR RESORTS, AND  
GIVING GUNS TO POOR SHOTS.

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HEY, IT'S GOOD -  
LITTLE OLD LADIES TELL LIES!

# Emerging Pockets of Very Resistant Tuberculosis

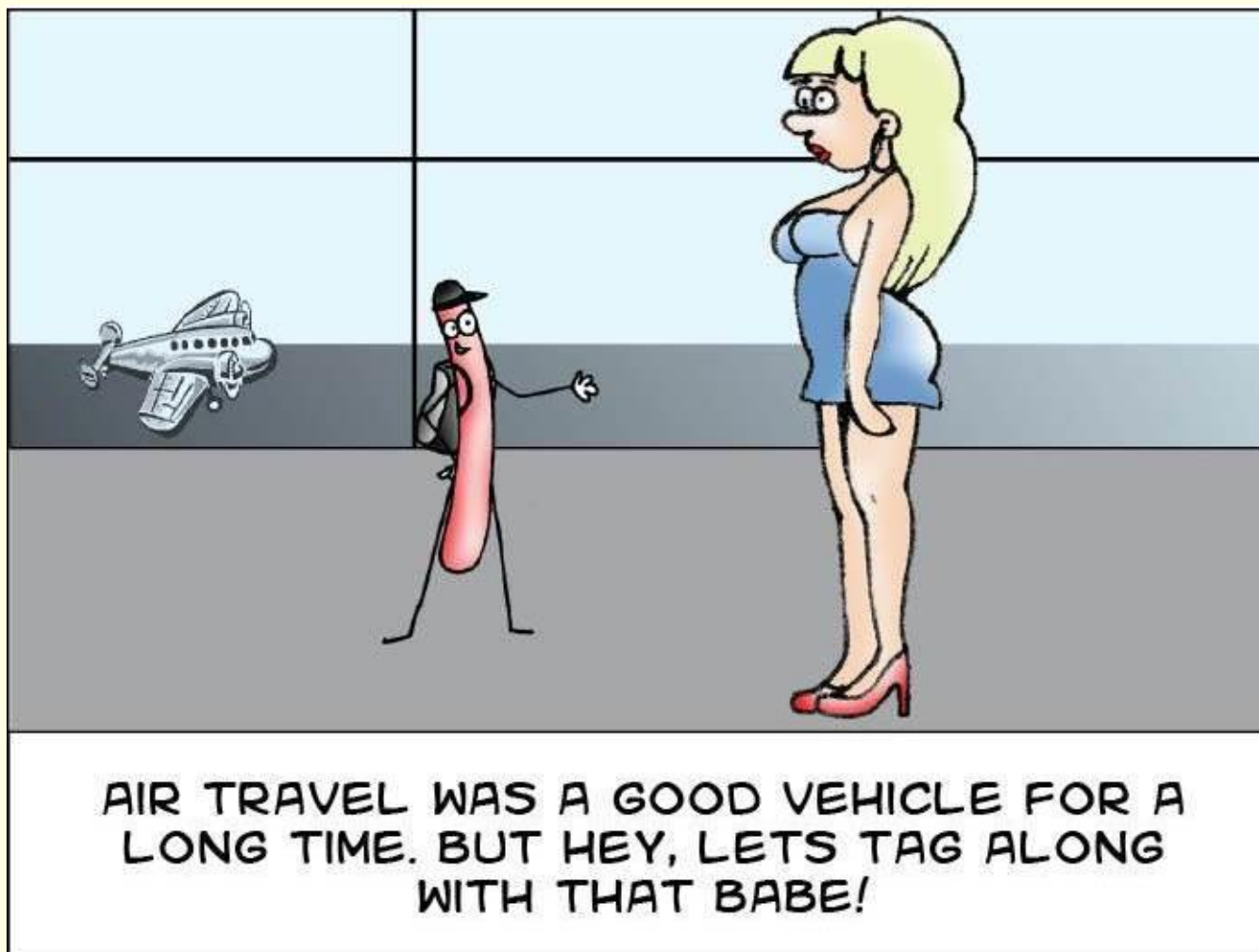
- United States: Elevated rates of TB and resistant tuberculosis in major cities, 1985-1992. The reasons are:
  1. TB infrastructure reduced.
  2. Development of HIV.
  3. Immigrant influx.
  4. Drug culture expansion.
- Peru: 1980-1990. Bloody civil war. Disrupted health care, economy, and social life for years.
- Eastern Europe: Emergence of resistant tuberculosis due to
  1. Political dislocation due to collapse of the Soviet Union.
  2. Prison design.
  3. Treatment similar to TB management in the 1940's.
  4. Lack of follow-up prison release to society.
- Sub-Saharan Africa and Southeast Asia: Due to
  1. Impoverishment.
  2. Political disorganization.
  3. Inadequately organized health care delivery.
  4. Epidemic HIV and sexual practices.
  5. 80% of tuberculosis in Sub-Saharan Africa is associated with HIV. WHO 2009.



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- 1957: JOHN CROFTON ESTABLISHED THAT IF TUBERCULOSIS IS TREATED WITH THREE DRUGS UNDER SUPERVISION FOR EIGHTEEN (18) MONTHS TB IS CURED WITHOUT RELAPSE OR THE DEVELOPMENT OF RESISTANCE. "TB WAS 100% CURABLE".



# Co-infection: HIV and Tuberculosis

- **One-third of 33.2 million HIV TB patients globally will develop active tuberculosis at a rate of 10% per year**
- **In sub-Saharan Africa, 50% of TB cases are also HIV positive**
- **HIV and TB enhance each other**
- **Public Health infrastructure, education, and economic development are lacking in endemic areas**





**HEY, WE CAN FIGHT BACK. THE POOR  
SHOOTERS ARE BACK!**

## GLOBAL TB PROBLEM

2,000,000,000 people infected with TB worldwide

50,000,000 of these have drug resistant TB

15,000,000 have TB infection

1,700,000 die annually of tuberculosis

400,000 new MDR-TB cases annually

27,000 XDR-TB annually

## Extensively Drug Resistant TB (XDR-TB)

The XDR-TB afflicted, the modern leper of biblical description, is the consequence of inadequate and incomplete tuberculosis treatment.

## RATES OF MDR-TB AMONG PREVIOUSLY TREATED CASES OF TB IN SELECTED COUNTRIES/REGIONS

Country/Region	Year	% of MDR among PREVIOUSLY TREATED CASES	% of any resistance (1 or more drugs) among PREVIOUSLY TREATED CASES
Kazakhstan	2001	56.4	82.1
Lithuania	2002	53.3	67.9
Estonia	2000	45.3	58.1
Russian Fed. – Tomsk Oblast	2002	43.6	60.7
Russian Fed. – Orel Oblast	2002	42.4	73.3
Uzbekistan – Karakalpakstan	2001	40.2	79.4
Egypt	2002	38.2	68.2
China – Henan	2001	36.6	60.8
Latvia	2000	27.1	38.1
Ecuador	2002	24.8	47.4
Mexico (Baja CA, Oaxaca, Sinaloa)	1997	22.4	41.1
United States	2001	5.2	18.8

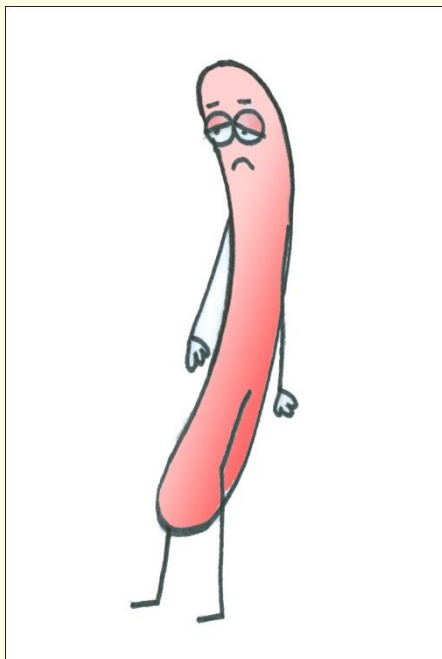
Source: WHO

For statistics from all geographic regions surveyed by WHO, see [http://www.who.int/gtb/publications/drugresistance/2004/drs\\_report\\_1.pdf](http://www.who.int/gtb/publications/drugresistance/2004/drs_report_1.pdf)



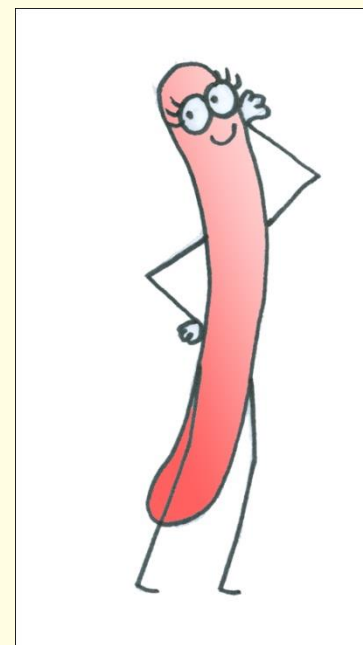
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## TUBO



- Lack of resources in global battle
- Prospect of TB vaccine poor
- AIDS treatment difficult & expensive
- Lack of infrastructure for TB treatment
- Increasing population

## TUBE



- Prospects for AIDS vaccine
- New drugs in pipeline
- Public Health strengthening
- They may finally follow Crofton's plan

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